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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/762,013	01/21/2004	Michihisa Maeda	42P9978C	4494

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EXAMINER	
NOVACEK, CHRISTY L	
ART UNIT	PAPER NUMBER
2822	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/762,013	MAEDA ET AL.	
	Examiner	Art Unit	
	Christy L. Novacek	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 October 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/16/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This office action is in response to the amendment filed October 16, 2006.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 3, 4 and 7-13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Yagi et al. (US 6,109,507, previously cited) and Kimura et al. (US 6,400,034, previously cited).

Regarding claim 1, Applicant's own admitted prior art discloses applying a no-clean flux to a first surface of a substrate having solder bumps attached thereto. The solder bumps are aligned and brought into contact with corresponding metal bumps (protrusions) that are attached to a first surface of a chip. The solder bumps are heated to a first temperature that is equal or greater to the melting temperature of the solder bumps. The admitted prior art discloses using a flux, which does not have a volatilization temperature less than the melting temperature (paragraphs 0004-0006). Like the admitted prior art, Yagi discloses a process of applying solder and flux to a substrate and using heat to attach the solder to the substrate. Yagi discloses that it is advantageous for the flux to have a volatilization temperature less than the melting point of the solder because that way, voids in the solder ball caused by trapped air bubbles can be prevented (col. 13, ln. 24-31). At the time of the invention, it would have been obvious to one of ordinary skill in the art to substitute the flux of Yagi in the invention of the admitted prior art because Yagi's flux leaves behind no undesirable voids in the solder balls, thus improving the reliability of the bond between the chip and the substrate.

Further regarding claim 1 and claims 3, 4 and 7-13, Applicant's admitted prior art does not disclose a method for heating the solder bumps and joining the chip to the substrate. Like the admitted prior art, Kimura discloses a process of flip-chip bonding a substrate to a chip wherein metal contacting the chip and substrate is used to bond the chip and substrate together. Kimura teaches using a thermo-compression bonding tool to effect the flip-chip bonding. By this method, the substrate is attached to a lower platen (first fixture) that is maintained at a temperature of 70°C (less than the melting point of the solder), the chip is attached to a heater fixture (second fixture) which applies both heat (at a temperature of 300°C) and a pressure (at a force of 75-125 gf/bump) to a second surface of the chip whereby the heat is conducted through the chip such that the metal becomes bonded to both the chip and the substrate. The heat and pressure are applies to the chip for a time period of 2.5-7.5 seconds to conduct the bonding and then the contact force is removed (col. 6, ln. 64 – col. 7, ln. 35). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the thermo-compression bonding method of Kimura to effect the bonding of the chip to the substrate of the admitted prior art because the Kimura teaches that using his particular thermo-compression process, a chip can be bonded to a substrate with reduced heat and pressure application.

Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Yagi et al. (US 6,109,507) and Kimura et al. (US 6,400,034), as applied to claim 1 above, and further in view of Hur et al. (US 6,013,572, previously cited).

Regarding claim 2, Applicant's admitted prior art does not disclose the materials that make up the first surface of the chip. Like the admitted prior art, Hur discloses a method of

bonding a chip to a substrate using solder bumps. Hur teaches that a chip surface having bonding pads including copper can provide strong adhesiveness to the chip and is strong enough to withstand damage during subsequent processing (col. 3, ln. 60 – col. 4, ln. 14; col. 6, ln. 56-67). Hur also teaches that methods of manufacturing this type of bonding pad are well-known in the art (col. 4, ln. 12-14). At the time of the invention, it would have been obvious to one of ordinary skill in the art to form the bonding pads on the surface of the chip of the admitted prior art such that they are the copper-containing bonding pads of Hur because the admitted prior art does not disclose any particular bond pad material and Hur teaches that a bond pad including copper has strong adhesiveness and increased durability.

Regarding claim 5, Applicant's admitted prior art discloses that conventional solder is made of 97% Pb and 3% Sn. Like the admitted prior art, Hur discloses a method of bonding a chip to a substrate using solder bumps. Hur teaches a method whereby the solder bumps are comprised of 96.5% Sn and 3.5% Ag (col. 7, ln. 42-43). Hur states that the Sn/Ag solder bumps are advantageous over the conventional Pb/Sn solder bumps because lead is harmful to the environment (col. 1, ln. 35-47). At the time of the invention, it would have been obvious to one of ordinary skill in the art to replace the Pb/Sn solder balls of the admitted prior art with the Sn/Ag solder balls disclosed by Hur because Hur teaches that it is advantageous to use Sn/Ag solder balls instead of Pb/Sn solder balls because lead is harmful to the environment.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Yagi et al. (US 6,109,507) and Kimura et al. (US 6,400,034), as applied to claim 1 above, and further in view of Arbib (EP 0077622, previously cited).

Regarding claim 6, Yagi discloses that it is beneficial to use a flux that has a lower boiling point than the melting point of the solder, but Yagi does not disclose any particular flux. Like Yagi, Arbib discloses using a flux to assist in the bonding of electronic components and also teaches that the flux should have a lower boiling point than the soldering temperature. Arbib discloses that this type of flux preferably comprises a flux material having at least one carboxylic acid group (Abstract). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the flux of Arbib to do the solder bonding disclosed in the admitted prior art because both Yagi and Arbib teach using a flux that has boiling point below the soldering temperature and Arbib discloses that this type of flux can successfully be made using a flux material having at least one carboxylic acid group. It would also have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal boiling point of the flux, depending upon the type of solder being used because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Response to Arguments

Applicant's arguments filed October 16, 2006 have been fully considered but they are not persuasive.

Regarding the rejection of claim 1 as being unpatentable over Applicant's admitted prior art in view of Yagi and Kimura, Applicant argues that the admitted prior art discloses using a flux having a volatilization temperature at or above the solder melting point. Yes, this is what is disclosed in the admitted prior art. However, the Yagi reference teaches that it is advantageous to use a flux having a volatilization temperature below the solder melting point, as opposed to

the flux disclosed by the admitted prior art, because by having the flux evaporate before the solder melts, voids in the solder balls caused by trapped air bubbles can be prevented (col. 13, ln. 24-31). Thus, Yagi discloses the claim 1 limitation of using a flux having a volatilization temperature that is less than the solder melting temperature and Yagi also discloses motivation as to why one of ordinary skill would use that type of flux instead of the conventional type of flux disclosed in the admitted prior art. Therefore, the rejection of claim 1 as being unpatentable over Applicant's admitted prior art in view of Yagi and Kimura is maintained.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday 4:00pm - 8:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
February 1, 2007

Michael Trinh
Primary Examiner